Acknowledgement

I humbly grab this opportunity to acknowledge reverentially many people for their varied contributions during my Ph.D research and the making of this thesis.

Foremost, I would like to express my sincere gratitude to Dr Vibha Dhawan, my supervisor for her guidance, suggestions, motivation and continuous encouragement during the course of this work at TERI University. The innumerable opportunities and support she offered are invaluable and helped me enriching myself personally as well as professionally.

I wish to express my warm and sincere thanks to Dr R K Pachauri, Director General, TERI and Dr Bhavik R Bakshi, Vice Chancellor, TERI University for providing me with the infrastructure support. I sincerely express my gratitude to my Student Research Committee (SRC) members Dr Sanjay Saxena, Dr Nutan Kaushik and Dr Saon Ray, for the periodic assessment of my work and their valuable suggestions. I am grateful to Dr Sanjay Saxena for providing critical insights and making me learn not only the execution of the experimental work but also aspects of writing it scientifically. I also wish to thank Dr Gp. Cpt. Rajiv Seth, Registrar, TERI University for all the support during the course of my work. Financial assistance from the Council for Scientific and Industrial Research (CSIR) in the form of Junior and Senior Research Fellowship is duly acknowledged.

I am also indebted to Dr Manju Modgil, Professor, Department of Biotechnology, YS Parmar University of Horticulture and Forestry, Solan (H.P) for providing me the research material and for sharing her expertise on the subject. I owe gratitude towards Dr J.S. Chandel and Dr M.S. Mankotia for their indispensable help in providing me the plant material, helping me to learn the art of grafting and conducting field experiments related to grafting and transplantation at Solan and Mashobra. It is a pleasure to express my gratitude wholeheartedly to Dr Manisha Thakur, Sheetal, Ranjana, Parul, Shikha and Taruna for their kind hospitality during my stay in Solan.

My sincere thanks to Dr A.K. Singh, Head, Division of Fruit and Horticultural Technology, IARI whose invaluable advice in concepts and experimental work in the field of horticulture improved the quality of this study.
I wish to thank Mr Yateen Joshi, Dr Arvind Seth, Dr Nidhi Chanana, Dr Indira Parthasarathy and Dr Atimanav Gaur for their guidance and help during the pre-PhD coursework. I express my gratitude towards Dr Mahaveer Sharma who guided me in doing the minor project during the coursework.

I would also like to thank Dr Shashi Bhushan Tripathi, Dr Anandita Singh and Mr Madan Singh Negi for helping me in the clonal fidelity experiments. Sincere thanks are extended to Dr Alok Adholeya and Dr Reena Singh for providing the mycorrhizal inoculum for my experimentation. I extend my heartfelt gratitude to Dr Shanuja Beri, Mr Hetram and Dr Bhupendar Giri for their help during mycorriza experiments.

I would like to express my gratitude to Dr Neetika Walia and Mr Anoop Sharma for their help at various stages of my work. I gratefully acknowledge Mr Jagram, Mr Ramgopal and Mr Dewari for helping me conduct the hardening and grafting experiments at Gual pahari. I am thankful to Mrs Alka Malhotra, Mr Birender Bharti, Mr Kamlesh Kumar, Mr Narayan Chand, Mr Nandan Singh and Mr Rajkumar Bharti for the cheerful and congenial work atmosphere. I gratefully thank Mr Arvind Rana, Mr Ashok and Mr Avdesh for helping me carrying out experiments at Supi, Mukteshwar and taking care of my plants. My sincere gratitude to the library staff especially Mrs Radhika and Mrs Sonia Sethi. Thanks are due to Mr Kamal Sharma, Mrs Pratibha, Mr C.T. Sebastian and Mr Sunil for administrative help from TERI University. Thanks are also due to the IT help desk, electricians, photocopying and dispatch departments.

I am blessed with helpful seniors Dr Deepak Prem, Dr Kadambari Gupta, Dr Srivalli Krishnan, Dr Vanit Kathuria and Dr Deepak Pant. I would like to specially acknowledge Dr Pooja Joshi in whom I got my elder sister and Dr Nishritha Bopana who helped and supported me in all the countless ways. Sincere thanks are extended to my juniors Anshul, Akhil, Gopal, Priyanka, Shivraj, Shikha, Pratima, Shyam, Susheel, Sonia Saini, Sherin, Richa, Tulika, Shanthi and Tanya. I would also like to thank my batchmates Dr Yamini Satayawali, Dr Guneet Kaur, Prakashkiran Pawar, Susmita Sahu, and Pratibha Nair. I feel privileged to have spent memorable and exhilarating time together in lab with Nishritha, Sangeeta, Divya during the coffee time and discussing a wide range of topics. I express my
deepest gratitude and love towards Richa, Tulika, Gopal and Deepshikha for helping me in writing and diligently proof reading my thesis and supporting me in my toughest time.

“A mirror reflects a man’s face, but what he is really like is shown by the kind of friends he chooses.” Words alone cannot express my sense of gratitude and affection to my friends Monica, Anudeepthi, Shipra, Nayan, Paras, Dr Roopam Sharma, Seema, Arun, Rachna and Dr Anita who stood by me through all thick and thin and the memories of the time spent with them will be cherished by me throughout my life. I would like to extend my heartfelt thanks to Kirti whose mere presence is a drive to always move forward in life carrying a positive attitude. He made me believe in myself and through his love, motivation, patience, moral support and understanding attitude enabled me to complete this task successfully. Thank you all for being there with me always!

I praise God, the almighty for bestowing me this opportunity of fulfilling my ambition, though he tested my perseverance and determination twice, first during the beginning of my work when my cultures got spoiled due to earthquake and secondly, near the end when I was saved from the serious accident just before the submission of my thesis.

Where would I be without my family? I am lucky enough to have blessings and prayers of my grandmothers Mrs Ganga Devi and Mrs Shanti Belwal and my grandfather Mr H.D. Belwal. I am thankful to the loving kids Utkarsh and Poorva for constantly being the source of joy and playing with them was the greatest stress buster howsoever difficult time I had. I would also like to thank my brother Sumit from whom I learnt to have self confidence, who helped me at any hour of the day whenever I asked it for and filled laughter in my life with his sharp sense of humour. Above all, I owe my parents Mr B C Pathak and Mrs Neema Pathak much beyond expression. They gave me all the freedom to pursue my dreams and supported me by all the means to make them come true. I can never forget the painstaking efforts of my dear family who catered to my just and unjust demands to make this journey a memorable one. It is their love, affection, sacrifice, prayers and blessings which enabled me to surge ahead and without whom this treatise would have remained an ambition. More than me, it is they who have devoted their time into this work by being so patient and supportive in all these years.

I dedicate this work to you Papa, Mamma and Sumit!